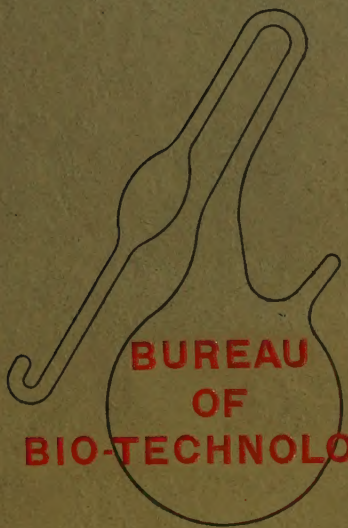
BULLETIN No. 1

JULY 1ST, 1920



BUREAU
OF
BIO-TECHNOLOGY

IMPERIAL BUREAU
18 AUG 1921
OF MYCOLOGY

THE BUREAU OF
BIO-TECHNOLOGY
QUEEN SQUARE,
LEEDS

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JULY 1ST, 1920

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THE BUREAU OF BIO-TECHNOLOGY

□ QUEEN SQUARE, □

□ L E E D S □

FOREWORD

IN future issues of the Bulletin of the Bureau of Bio-Technology it is proposed to print original papers on matters arising out of our activities which, it is hoped, will constitute a useful, if small, contribution to micro-biological science in one or other of its various technical aspects.

As it is felt that the nature of our activities should be known to a greater number of those to whom industrial biological problems are of every-day occurrence, this issue contains a reprint of an article contributed to a weekly contemporary which will introduce to the reader in general terms an account of the Bureau and the scope of its work.

Correspondence on any Bio-Technical subject will be welcomed, and scientific readers are invited to apply for copies of this Bulletin to be sent to industrial and commercial friends whom it may interest.

BUREAU OF BIO-TECHNOLOGY,
LEEDS.

July 1*st*, 1920.

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Microscopy and Biology in Industry.

F. A. MASON.

Reprinted from "The Chemical Age," April 17th, 1920.

IT may be stated at the outset that the Bureau of Bio-Technology is new only in name. It is true that in recent years the scope of its work has been greatly enlarged, but the laboratories from which it has grown have been in existence for many years. In addition to the ordinary routine chemical and biological control of raw materials and products associated with the fermentation and food industries, researches of a biochemical and biological nature have been in continuous progress, but, as these have been mainly of a private nature, arising in the ordinary course of consulting work, little has been published. Reference may be made, however, to the fact that the results of certain investigations carried out in these laboratories have been published from time to time, some of them more than 20 years ago; they include researches on the Pure Yeast Question,[1] Barley[2] and Malting,[3] and are well known in the literature of the industries to which they apply.

In a consulting practice extending over a period of 25 years, we have, throughout, recognised the intimate relationship of biology and chemistry in the technology of many of those

[1] Murphy, A. J., "Some Aspects on the Pure Yeast Question," *Journ. Inst. Brew.*, V., 1899.

[2] Murphy, A. J., "Some Estimations on 1902 Barleys," *loc. cit.*, IX., 1903.

[3] Murphy, A. J., "The Germination and Kiln Drying of Barley," *loc. cit.*, X., 1904.

branches of industry still referred to as "chemical industries." So far as we are aware, we were for many years the only private firm of technical chemists which, in addition to the usual chemical laboratories, staffed and maintained specially equipped microscopical and biological departments. By so doing we were able to carry through, from beginning to end, investigations which must have been left incomplete in the hands of the analyst or technical chemist working under usual conditions of laboratory equipment and control.

Recent Advances in Technology

In discussing the advantages of technology during the last decade it is hardly possible to mention any branch of industry which has not received direct benefit, and in some cases, considerable impetus, from the application of methods of microscopical research. Even in the industries concerned with materials of inorganic origin —*e.g.*, refractory substances, abrasives, building and road-making materials, iron, steel and non-ferrous metal production, paints and pigments, pure chemicals, &c.—the microscope is a valuable aid in the technological examination of the raw and finished products. In the apparently unlikely field of mining and fuel production, the microscope has proved of inestimable value. Its aid has been called in for investigating the causes of colliery explosions, and, although playing a comparatively small part in the investigation, it nevertheless gave information not obtainable in any other way and which when co-ordinated with other available data, completed a research which led to the adoption of means of safeguarding the lives of thousands of our colliery workers. It is recorded that so far back as 1833, the microscope had begun to be used for the examination of coal, and a recently published monograph on the "Constitution of Coal," published in 1918,[4] not only gives a résumé of the microscopical work done since that time but is itself a monument to the importance of the microscope in present-day methods of elucidating a difficult technical problem.

[4] Stopes, Marie M., and Wheeler, R. V., "Monograph on the Constitution of Coal," *Dept. of Sci. and Ind. Research*, 1918.

MICROSCOPICAL LABORATORY.

Fortunately, there is every indication that microscopy in its relationship to the requirements of technology is beginning to be viewed in proper perspective. In January of the present year, the Faraday Society together with the Royal Microscopical, Optical, and Photomicrographic Societies, held a symposium on "The Microscope: Its Design, Construction and Application" at Burlington House, and one could not fail to be impressed with the great gathering of eminent technologists representing every branch of industry, as well as with the diversity of apparatus and objects of commercial interest placed on exhibition. The symposium was not only a wonderful demonstration of the wide applicability of the microscope and of the refinements to which microscopy has already attained, but it foreshadowed the further advances and developments of microscopical technique to be expected in the near future.

With regard to the aspects of technology which are purely biological, the microscope performs an even greater service. During the war, chemical products, upon which hung the very life of the nation, have been manufactured in enormous quantities by new processes dependent upon the work of living organisms under conditions of control essentially micro-biological. Such processes were very largely in the hands of chemists, many of whom, in spite of the lack of training in biology, produced results undreamed of in pre-war times, and it is easy to speculate how much greater would have been the chances of developing efficiency and economy in these processes if the men in charge had been equipped with a biological training or had possessed ready means of access to all the known facts and literature of biotechnology. It would also have been the means of saving valuable time in isolating and experimenting with various micro-organisms, if such organisms, together with complete data of their biochemistry and biology, had been already available.

Relation to Chemical Industries

Many important contributions to the technology of "chemical industries" have been due to the fact than an investigator, usually

a chemist, engaged on some everyday problem happened to be familiar with biological methods or was skilled in microscopy. I say " happened " advisedly, because neither of the latter branches of science has been considered to lie within the legitimate scope of the chemist's profession. Men trained in both biology and chemistry are rarely met with in laboratories working under technical and commercial conditions ; if so qualified they are usually retained by, or find the most congenial work in, the laboratories of our Universities. In the old days the physicist looked upon chemistry as the dirty part of his subject—a side-line concerned with fireworks and stinks—and, in the same way, the chemist held the biologist in contempt as a philanderer with bugs, moulds, and other small fry, but, as the lines of demarcation between chemistry and physics have disappeared for ever, so surely has the day dawned when chemistry (and therefore physics) and biology in their relationship to science and technology can no longer be separated.

It is not difficult to gather from the signs of the times that the biological aspect of technology is being fully recognised, and the desirability of greater facilities for training and assistance in work of a biological nature duly appreciated. *Nature*, in its issue of August 28, 1919, comments upon a Paper on this important subject read at a conference held under the auspices of the Society of Chemical Industry in August of the same year, in which Mr. A. C. Chapman, a leading biotechnologist, proposed the establishment of a national institute for the study of biotechnics.[5] After referring to the inadequate provision in this country for systematic training in industrial microbiology and for the study of the innumerable problems on which it bears, the commentator says : " The first object of such an institute would be to provide for the systematic prosecution of research in connection with any industry in which micro-organisms or enzymes play an important part. Such industries—not to mention brewing and distilling—are, for example, the dairy industry, particularly cheese-making ;

[5] Chapman, A. C., " The Employment of Micro-Organisms in the Service of Industry," *Journ. Soc. Chem. Ind.*, XXXVIII., 1919.

(1) BACTERIOLOGICAL LABORATORY.
(2) BIOCHEMICAL LABORATORY.
(3) BIOLOGICAL LABORATORY.
(4) STUDENTS' LABORATORY.

Plate 2.

the bread-making and pressed-yeast industry; tanning; lactic acid making; the treatment of sewage; wine and vinegar making, and agriculture generally. Another function would be the specialised training of teachers of microbiology and biochemistry, and the practical instruction of technical employees. A further object would be the provision of organisms in pure culture for use in industry and the housing of as complete a collection of technical micro-organisms as could be got together. No such collection exists in the United Kingdom; scientific and other workers in want of a particular organism are compelled to apply to their friends on the chance that someone may happen to have a specimen, or else must send abroad for it."

What the Bureau is Doing

The Bureau of Bio-Technology is already fulfilling some of the requirements outlined above, not the least useful branch of its activities being that of the collection and maintenance of pure cultures of micro-organisms of industrial importance. Without these cultures as a starting point it is impossible to carry on investigations of the innumerable problems known to be due to enzyme action, our knowledge of the commercial value of which is only on the threshold. Part of such a collection is shown in the photograph of the Bacteriological Laboratory, Plate 2, Fig. 1. Here we are engaged in isolating various species of moulds, yeasts and bacteria, and cultivating them in suitable media either for reference or in a condition to be instantly available for any experimental work for which they may be required.

While bacteria and yeasts have received considerable attention from the biotechnical point of view, the moulds have been very greatly neglected, although, on account of their enzyme-producing properties, they are of the highest importance in many of the newer branches of technology, and the uses to which they may be applied are being almost daily extended. It is true that their study lies principally in the province of the mycologist, and, with a few conspicuous exceptions (mostly by foreign workers), the

investigation of these fungi outside purely biological consideration has been carried out in connection with their relationship to plant pathology.

As already mentioned, the lower fungi are of special interest to the technologist by reason of the readily demonstrated power of producing various enzymes. They have been also the subject of a good deal of attention from the biochemist, but there are few chemists in either this or any other country who have sufficient mycological experience to enable them to determine with certainty the specific nature of the organisms with which they may be dealing. The most important groups of fungi, from the technical point of view, are the Phycomycetes, the Hyphomycetes and certain Ascomycetes, and it is these very groups which, even to the mycologist, present special difficulties in the differentiation of species. Therefore it is not to be wondered at, that, for the chemist, it is an almost insuperable task to accurately name a specimen of what appears to be the commonest of moulds.

Typical Cases

Take as an instance, the genus *Penecillium* and the confusion likely to ensue from the foregoing considerations. In the standard chemical literature of to-day there are innumerable references and papers on the bio-chemistry of blue moulds, and in nearly all cases the plant is referred to as *Penecillium glaucum*. Now there are some 40 to 50 distinct species of blue moulds belonging to this genus, all of which behave differently when grown under conditions identically the same. On the surface of a given medium they develop similar, although microscopically different, forms of growth and colour (mostly from pale blue to deep green), but exhibit very different reactions both chemically and physiologically. They develop different enzymes over a very wide range and produce acids of various kinds in smaller or greater quantities. The submerged portion of the growing fungus gives rise to various coloured pigments distinct from those of the surface growth, which stain the medium ; some of them acting as delicate indicators,

others being very resistant towards the action of both acids and alkalies. In view of such varying behaviour among species within a single genus, it is a matter of the utmost importance to the biochemist that he should be certain of the identity of the organism he is investigating. Now Thom,[6] working on species of *Penecillium* in connection with the ripening of cheese in 1910, and Westling,[7] who monographed the genus in 1911, both came to the conclusion that there is no specific organism *Penecillium glaucum*; at any rate, there exists no diagnosis sufficiently clear to enable a mycologist to recognise the plant to which that name was first given. The result is that a great deal of research has been expended on an organism, or rather a number of organisms, none of which can now be identified, and a voluminous biological and biochemical literature, which, under other circumstances would have been of the greatest possible service to the bio-technologist, is practically valueless.

Similar difficulties confront the technologist in regard to species of the *Mucoraceæ* used for the saccharification of starch materials in various fermentation processes, and many of which are themselves capable of fermenting saccharine liquids with the production of alcohol up to 7 per cent. The same may be said of species of *Aspergillaceæ*, also possessing highly diastatic properties, an example of which, *A. oryzæ*, is the fungus used in Japan for the preparation of Saké, the national drink of that country. Practically all the enzymes known are found in different species of *Aspergillus* and some members of this family possess the special property of producing organic acids, particularly oxalic and citric acids, from carbohydrate solutions; and, undoubtedly, the production of these acids by species of fungi on a commercial scale will be accomplished at no distant future.

If the Bureau of Bio-Technology can assist in remedying the chaotic state of affairs, illustrated above, by rendering available

[6] Thom, C., "Cultural Studies of Species of Penecillium," *Bureau An. Ind. U.S. Dept. Agric.*, Bull. 118, 1910.

[7] Westling, Rich., "Über die grünen Spezies der Gattung Penecillium," *Arkiv. för Botanik.*, XI., 1911.

pure cultures of such technical organisms as those referred to, this branch of its activity will be more than justified. Collections of fungi of economic importance there are, of course, in existence, but the writer knows of no other collection of organisms in conjunction with which will be found the necessary experience in their technological applications.

Not only do the moulds above mentioned find a useful application in industry, but they are, unfortunately, among some of the most destructive pests with which the manufacturer and the consumer has to contend. Considerable financial losses occur annually through the depredations of the lower fungi among cereal products, sugar and confectionery, textiles, leather, tobacco, &c., to say nothing of the vast amount of damage done by the same organisms in the agricultural, arboricultural and horticultural industries; in this connection also there is a wide field for investigation for which the Bureau of Bio-Technology is well equipped.

It is not possible in the space at disposal to do more than mention in passing the subject of yeasts and their growing industrial value. Many species occur in nature[8], the properties of which are only imperfectly known and the possibilities of their technical application still unexploited. A number of these are being isolated and investigated in this Bureau.

Industrial Bacteriology and Zoology

Industrial bacteriology is, of course, inseparable from the work of a Bureau of Bio-Technology, but to generalise on this subject here would only result in traversing the ground admirably covered in a paper by Thaysen,[9] read at the last meeting of the British Association at Bournemouth. Nor is it possible to discuss the interest attaching to the higher points in their relationship to industry, but the study of all aspects of botany is provided for in our laboratories.

[8] Mason, F. A., "On the Occurrence of Yeast-fungi in Nature," *Naturalist*, January, 1913.

[9] Thaysen, A. C., "Bacteriology, its Practical Applications and its Importance Outside Medicine," *Journ. Inst. Brew.*, XXVI., 1920.

Zoology is another branch of biological science of which little cognisance has been taken in industry, although a considerable number of animal organisms, ranging from the minute unicellular protozoa to the insects and even higher animals, involve the manufacturer and the merchant in frequent and often serious loss. Grain and other foodstuffs, tobacco, oils and fats, leather and many other commodities all have their insect or other animal pests. Except by Government Departments, which are more particularly interested in the economic aspects of zoology (mainly entomological) in relation to agriculture and horticulture, no facilities have existed hitherto for dealing with the examination and investigation of such organisms in the ordinary course of technical control. As an illustration of the necessity of such control, a case of serious damage occurring in sheep-skins during the removal of wool in the sweating process, was submitted to us for examination, thousands of pounds worth of damage having been done in one tannery alone by the agency of some pest hitherto believed to be bacterial. Our investigations proved that the organism responsible is a minute nematoid worm. The life history of this pest has been studied, and the results obtained have enabled us to devise methods for its eradication.

The reader who closely follows the literature of any department of technology must have been impressed with the fact that modern developments are ever along lines of microscopical or biological research. Formerly the microscope was kept under a glass shade in some conspicuous place in the laboratory, more as an ornament or a symbol, after the manner of the show carboys so familiar in the window of the pharmacist. To-day that instrument has come to occupy a position in industrial technique second only to that of the chemical balance, while in many directions it is, to say the least, quite as important as the balance. Therefore, in offering these notes on the work of a Bureau of Bio-Technology specialising in the biological and other aspects of industry in which the microscope is a *sine qua non*, the writer believes he is giving publicity to a species of service long overdue.

System in the Nomenclature of the Bacteria.

A PLEA FOR MORE COMPREHENSIVE METHODS OF CLASSIFICATION.

EVERY bacteriological worker is familiar with that feeling of clogging uncertainty which exists with regard to the specific identity of any organism he may have under observation or experiment. Unlike the botanist or zoologist, equipped with a complete systematic account of every unit in his flora or fauna, as the case may be, the identity of which can be checked by visual examination, the bacteriologist is concerned with an overwhelming number of organisms varying little in morphological features yet differing, often profoundly, in physiological behaviour. The data required to diagnose a bacterium with the accuracy necessary for future recognition extends beyond the limit of the older biological science into the region of bio-chemistry. It is because this fact was not grasped by the earlier bacteriologists and is still not appreciated by many contemporary workers that bacteriology is hardly worthy of rank as a science inasmuch as it lacks that system of thought and arrangement which alone is science. The "free lance" method of investigating bacteria has had two effects on the systematics of the subject; on the one hand different names have been given to the same organism, and, on the other, different organisms

having similar properties up to a certain point restricted by empirical methods of examination have been given the same name. The consequence of this is that any list purporting to give the species of bacteria known at this date is a confusion of synonyms and names of organisms inadequately described and incapable of recognition, with comparatively few species upon which any degree of reliance can be placed.

This important aspect of bacteriology is discussed at length by Erwin F. Smith in "Bacteria in Relation to Plant Diseases," Vol. I, 1905, and although, since that date, the American Society of Bacteriologists has devised a scheme for the more complete examination of bacteria and ~~have~~ published particulars of a Numerical System of recording the salient characteristics of an organism, very little progress has been made, except in regard to pathogenic plant-bacteria by the author above mentioned. It is essential, however, that some system should be applied to the differentiation of organisms in every branch of industrial bacteriology. Recent literature is full of loose facts and half statements regarding organisms on which the technical mycologist is in need of daily information, and, in illustration, the following paragraphs are abstracted from a Textbook in use in nearly every College and University in the kingdom. Reference need not be made to the title of the book, because the defects are not those of the author's treatment of the subject, but are due to the want of thoroughness in the builders of the science he is endeavouring to consolidate.

> "*Bacterium fluorescens liquefaciens* Flügge and *Bact. pyocyaneum* Flügge. These organisms are morphologically alike and in many physiological characters very closely resemble each other. Another organism, *Bacterium fluorescens non-liquefaciens* Eisenberg (*Bacterium immobile*

Kruse), resembles the type but liquefies gelatine very slightly. It is nearly related, if not identical with *Bact. fluorescens putidus* Flügge."

"*Bacillus ellenbachensis*, a, Caron. The bacillus closely resembles *B. megatherium*, and according to some authorities is a form of variety of this organism. . . . . Its behaviour on the various media is very similar to that of *B. subtilis*."

"*C. dichotoma* is not infrequent in water pipes . . . . . the 'Bismarck brown' *cladothrix* of Houston is probably identical with this species."

"*Micrococcus flavus* . . . . . This species is said to be identical or closely allied to *Sarcina lutea* Flügge, but typical packets are not formed."

"*Str. lacticus*, ... It appears to be the same organism as *Bacterium lactis*, described by Lister.

Bacterium Guntheri, L. & N.
,, *lactis acidi* Leichmann.
,, *lactis acidi*, 1 & 2 of Conn.
Lactococcus lactis, Beijk."

Many other examples could be given, but the above quotations will serve to emphasize the point to which attention is desired.

Although the system of the American Society of Bacteriologists may not be the last word in methods of bacterial investigation, its use will at any rate lead to differentiation and arrangement on scientific lines.

In the Bacteriological Department of the Bureau of Bio-Technology a number of organisms have been isolated which are being investigated on these lines, and it is proposed to issue pure cultures, with which will be supplied a Characterisation Sheet giving biological and other data. A copy of this sheet is reproduced on

page 20, and a key to the numerical system from the "Descriptive Chart—Society of American Bacteriologists" is given below.

100·	Endospores produced.
200·	Endospores not produced
10·	Aerobic (Strict).
20·	Facultative anaerobic.
30·	Anaerobic (Strict).
1·	Gelatin liquefied.
2·	Gelatin not liquefied.
0·1	Acid and gas from dextrose.
0·2	Acid without gas from dextrose.
0·3	No acid from dextrose.
0·4	No growth with dextrose.
·01	Acid and gas from lactose.
·02	Acid without gas from lactose.
·03	No acid from lactose.
·04	No growth with lactose.
·001	Acid and gas from saccharose.
·002	Acid without gas from saccharose.
·003	No acid from saccharose.
·004	No growth with saccharose.
·0001	Nitrates reduced with evolution of gas.
·0002	Nitrates not reduced.
·0003	Nitrates reduced without gas formation.
·00001	Fluorescent.
·00002	Violet chromogens.
·00003	Blue ,,
·00004	Green ,,
·00005	Yellow ,,
·00006	Orange ,,
·00007	Red ,,
·00008	Brown ,,
·00009	Pink ,,
·00000	Non-chromogenic.
·000001	Diastatic action on potato starch, strong.
·000002	,, ,, ,, ,, feeble.
·000003	,, ,, ,, ,, absent.
·0000001	Acid and gas from glycerine.
·0000002	Acid without gas from glycerine.
·0000003	No acid from glycerine.
·0000004	No growth with glycerine.

The genus according to the system of Migula is given its proper symbol, which precedes the number thus:

Bacillus Coli (Esch.) Mig.	becomes	*B.*	222·111102
Bacillus Alcaligenes Petr.	,,	*B.*	212·333102
Pseudomonas Campestris (Pam.) Sm.	,,	*Ps.*	211·333151
Bacterium Suicida Mig.	,,	*Bact.*	222·232203

Correspondence on this subject is invited.

F. A. M.

EX. COLL. BACT. BUREAU BIO-TECHNOLOGY, LEEDS.

ORGANISM _____

LABORATORY No. _____ DATE _____

BRIEF CHARACTERISATION.

[Scheme adapted from the original chart of the Society of American Bacteriologists.]

MORPHOLOGY.

Vegetative Cells _____

Medium Temp. ____ Days

Limits of Size _____

Spore Formation _____

Motility _____

Involution Forms _____

Other Notes _____

Reaction to Gram's Stain

CULTURAL FEATURES.

Broth at 37°C. — Effect on Liquid; Surface Growth; Sediment

Agar at 37 C. — Form of Growth _____; Surface Appearance _____

Gelatine at 22°C. — Form of Growth _____; Surface Appearance _____

Gelatine Stab. at 22 C. — Surface Growth _____; Needle Growth _____

Potato at 22 C. — Growth _____; Other Remarks _____

Cohn's Solution _____

Uschinsky's Solution _____

BIO-CHEMICAL FEATURES.

Liquefaction — Gelatine; Casein _____; Starch _____

Milk _____

Dextrose _____

Saccharose _____

Lactose _____

Maltose _____

Glycerine _____

Other Sugars _____

Indol

Ammonia

Other Gases _____

Nitrate Reduction

Fluorescence _____

Chromogenesis

Other Information:

Numerical Symbol (according to the scheme of the Society of American Bacteriologists).

THE BUREAU OF BIO-TECHNOLOGY, LEEDS.

Notes from the Laboratories.

An Anomalous Skin Position.

A curious development is illustrated by Fig. 1, the skin having taken up a somewhat unique position relative to the wool.

As the remaining skin examined microscopically exhibits only the grain layer and no *corium* ("flesh"), it is suggested that the condition may have arisen in the following way :—

The pelt having slightly putrefied, has separated at the *Stratum adiposum* (fatty layer). Whilst a portion of the flesh side of the pelt adhered to the floor, or another pelt, the whole was pulled apart, the *corium* retaining the *Str. adiposum* with the wool bulbs, and the grain layer, remaining intact, passing along the wool fibres. Unfortunately as this was the only sample supplied this explanation could not be confirmed.

A very similar condition was obtained by allowing a piece of sheep skin to putrefy and then pulling the wool fibres through by various means.

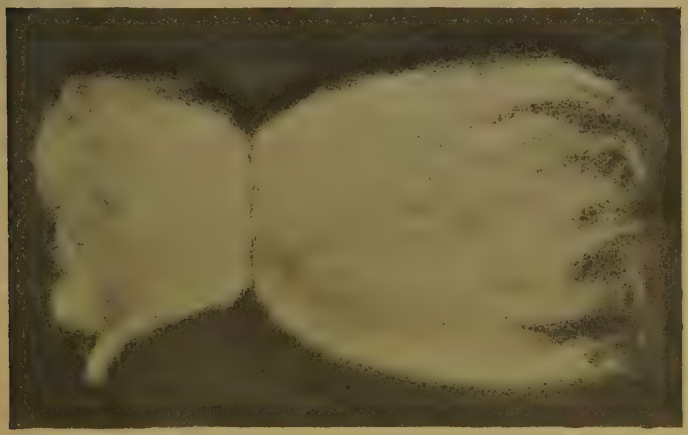

Fig. 1.

Mildew on Leather.

It is generally supposed that the black mould responsible for stains and unsightly spots on leather is *Aspergillus niger* (Van Tieghem), but from a sample of leather received here for examination we have isolated *Aspergillus luchuensis* (Inui). The latter species is morphologically quite distinct from the former, although to the naked eye the two fungi are indistinguishable. A. niger belongs to a group characterised by branched sterigmita, whereas in the case of *A. luchuensis* the sterigmata, bearing the conidia, are simple.

The Examination of Brewers' Yeast.

The following is a common laboratory experience illustrating the undesirability of placing too much reliance on microscopical examination without biological confirmation. A sample of beer was received with the complaint that the whole brew had gone sour within a fortnight of brewing, although under the microscope the yeast appeared to be good. A sample of the pitching yeast was obtained and examined. On microscopical evidence alone this yeast would have passed as satisfactory, but on incubation in sterile wort an acid beer was obtained which developed a thick film of foreign yeast and gave a deposit crowded with acid-forming organisms, thus reproducing the effects experienced under trade conditions and pointing undeniably to the instability of the yeast.

Inspection of Imported Plants.

Strawberry plants were received from a grower who had imported a considerable number from Holland. Some of these had been potted indoors and others planted out of doors, but in both cases most of the plants died before flowering. Of two plants sent for examination, one from indoors was found to be attacked by the Strawberry Eel-worm, *Aphelenchus fragariæ* as well as the Stem Eel-worm, *Tylenchus devastatrix*. An outdoor

specimen had one leaf showing the early stages of fungus attack, but an examination of the soil with these plants and with subsequent samples indicated that any imported defects were greatly aggravated by the condition of the soil in which the strawberries were planted. Leather-jackets, eel-worms and mites were present in considerable numbers, and attention was drawn to the importance of this point. In this connection reference may be made to the valuable work being done in America, in the inspection of imported nursery stock and bulbs by the Federated Horticultural Board, as described in a report just received.* Every shipment is examined, and between 40 and 50 different species of injurious pests were intercepted, a full list of which is given, and includes moths, beetles, bugs, scale insects, eel-worms and fungus diseases. One shrub contained masses of spiders' eggs, another a nest of rats. Holland appears to be the chief offender, but the list is not altogether free from the name of British exporters. If each of the 1,164,701 plants represented in the 131 shipments examined between December 1918 and June 1919, or even one per cent. of these, had contributed a single insect, mite or other organism, the resulting damage to the horticultural and agricultural industries might well be incalculable. It is at any rate a serious object lesson for horticulturists importing stock into our own country, and until legislative protection is afforded to safeguard British growers individual attention to this point will be well repaid.

A Discomycete New to England.

The occurrence of *Ascobolus Carletoni* Boud., a minute Discomycete, is being reported in *The Naturalist*, August, 1920. This fungus was first described in 1913 from specimens found in Perthshire, and until now not known from any other locality. Although of no technical importance, it will interest mycological readers to learn that this rare species was obtained on a new habitat in the Laboratory of the Bureau of Bio-Technology.

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* Nineteenth Report of the State Entomologist, 1919, Bulletin 218, *Conn. Agri. Exp. Stat.*, 1920.

THE BUREAU OF BIO-TECHNOLOGY,
LEEDS.

For the microscopical and biological examination of raw materials; the detection of defects in finished goods due to Mildew, Bacteria and other Micro-organisms, and the investigation of biological problems in the Dyeing, Bleaching, Textile, Tanning, Fellmongering, Milling, Baking, Sugar, Oils and Fats, Drysaltery and other industries.

The examination and determination of insect pests and fungus diseases in Agriculture, Horticulture and Forestry, and the investigation of methods for combating them.

Biological analysis of Barley, Malt, Wort, Yeast, Hops and Beer. The isolation and determination of all organisms occurring in Brewing, Distilling, Cyder, Wine and Vinegar making.

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